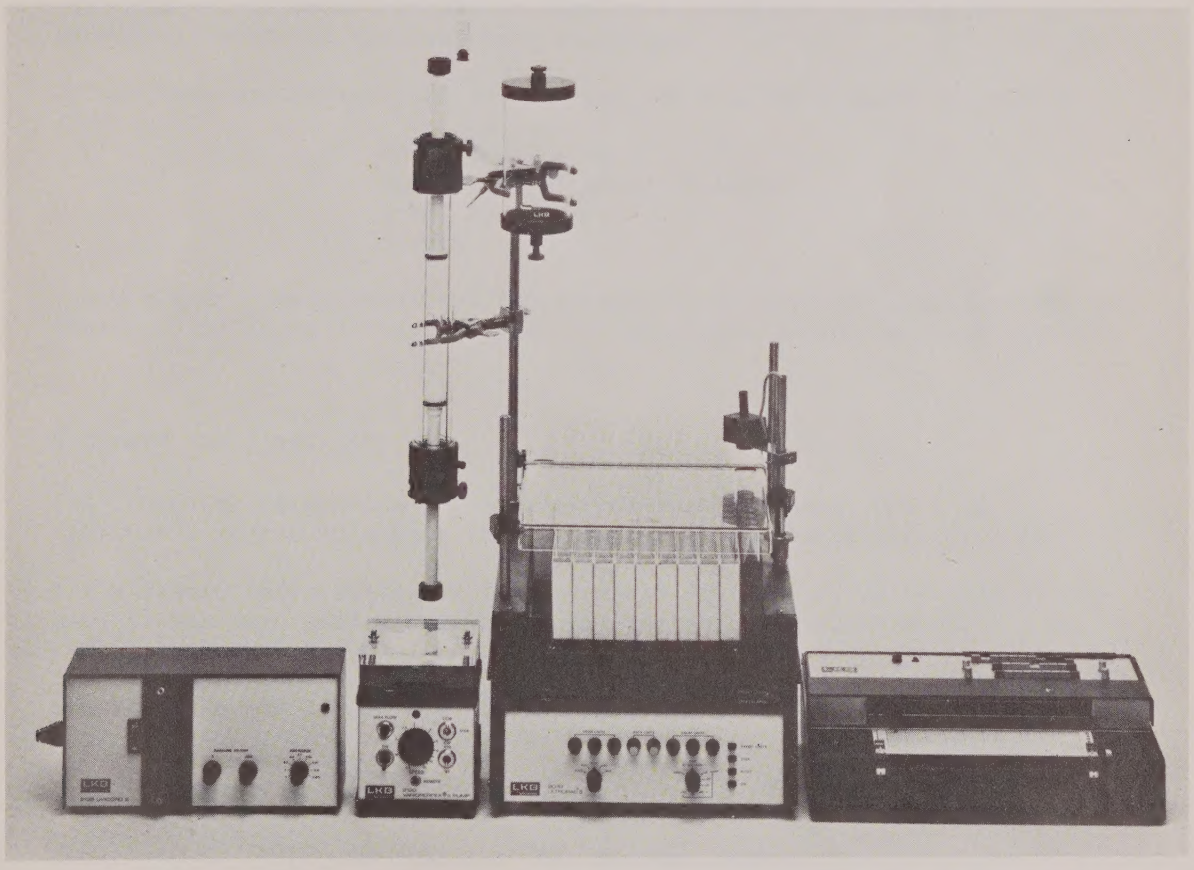
Instrument Manual

LKB

LKB 2070 UltroRac® II

I-2070-E02 90 00 2906

The Complete LKB Column Chromatography System



LKB 2138 Uvicord S UV-monitor. LKB 2120 VarioPerpex II Pump
LKB 2137 Chromatography Column. LKB 2070 UltroRac II Fraction Collector
LKB 2210 Recorder

PLEASE READ THIS MANUAL CAREFULLY BEFORE ATTEMPTING TO USE THE INSTRUMENT.

In the manual you will find a white section describing the physical features of the instrument and a yellow section describing its operation. These two sections should be studied carefully before the instrument is used.

In addition to this Instrument Manual you are supplied with a Spare Parts Catalogue. A Service Information Manual will be provided if you write to the address below.

However, LKB can only be responsible for the effects, on safety and performance, of modifications or repairs carried out by us or in accordance with our approved specifications.

If you have any comments on this manual, we will be pleased to receive them at:

LKB-Produkter AB
Research Instruments Division
S-161 25 BROMMA 1
Sweden

Since product development and improvement is a continual process, LKB reserves the right to make changes in the specifications without notice.

WARRANTY AND LIABILITY

LKB-Produkter AB guarantee that their delivered product has been thoroughly tested to ensure that it meets its published specification.

The warranty included in the conditions of delivery is valid only if the product has been used according to the instructions supplied by LKB-Produkter AB.

LKB-Produkter AB can accept no liability for loss or damage, however caused, arising from the faulty or incorrect use of their product.

Copyright c 1977 LKB-Produkter AB, Bromma, Sweden.

CONTENTS

		PAGE
I.	INTRODUCTION	5
II.	PHYSICAL DESCRIPTION	7
	Collection Platform	7
	Drop-Counter Head	7
	Control Panel	9
	Rear Panel	13
	Additional Equipment supplied	15
III.	INSTALLATION	
	Setting up the Fraction Collector	17
	Connection of Accessory Equipment	19
IV.	OPERATION	
	Self Instruction and Instrument check	21
	Collection by TIME	23
	Collection by DROP-COUNTING	25
	Collection by PUMP Control	25
	End of Run	27
V.	APPENDICES	
	Appendix A - Factors Affecting Fraction Volume	29
	Appendix B - Pump Calibration	33
	Appendix C - Callibrating Delay Volume	37
	Appendix D - Maintenance	41
	Appendix E - Technical Specification	43
	Appendix F - Equipment Supplied and Optional Accessories	45

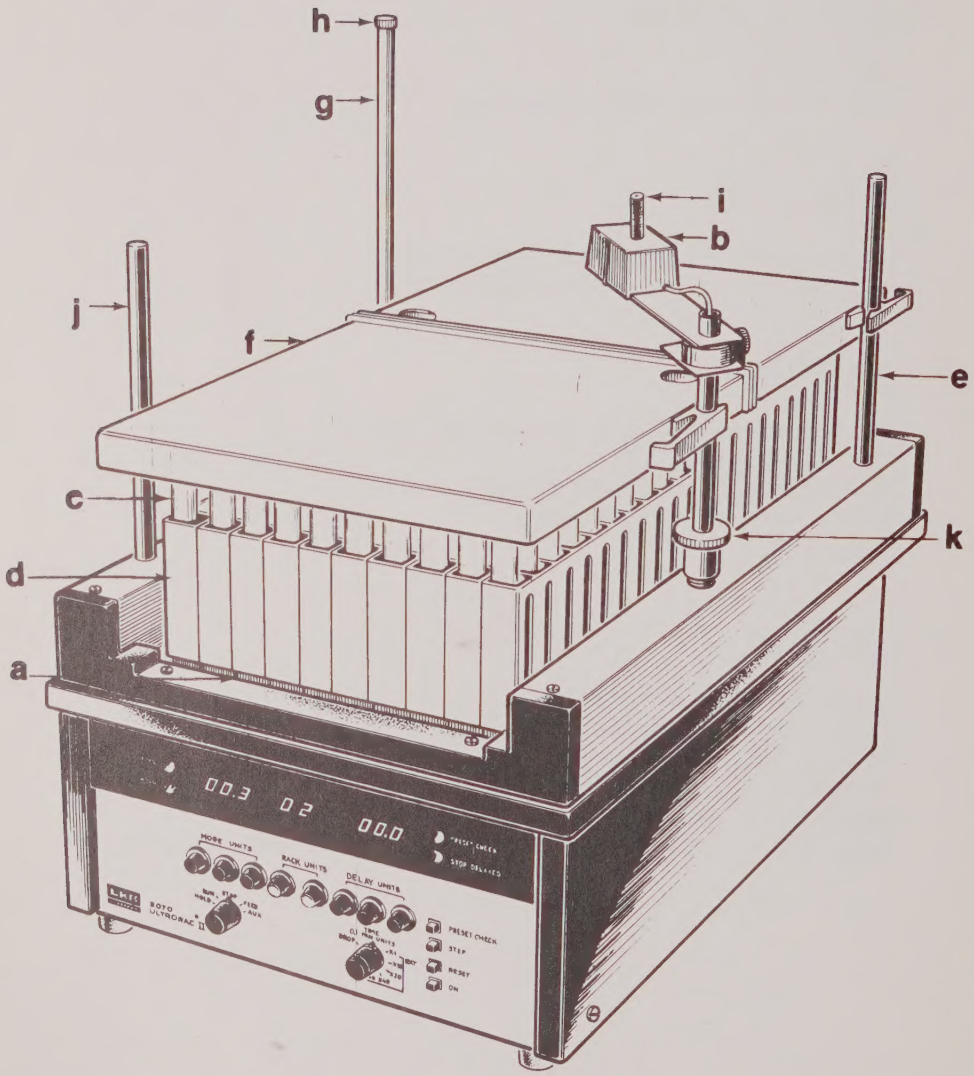

h
g
i
b
j
f
e
c
k
d
a
00.3
02
00.0
PRESET CHECK
STOP DELAYED
MODE UNITS
RACK UNITS
DELAY UNITS
PRESET CHECK
STEP
RESET
ON

Fig. 1.

INTRODUCTION

The continuing and expanding use of preparative column chromatography techniques, in an atmosphere of ever increasing material and salary costs, puts even greater demands on the final fractionation step.

A modern fraction collector must fulfil many demands including the number of tubes to be processed, tube size, compactness and the ability to operate in either ambient or coldroom conditions. It must also form an integral part of a complete chromatography system, but above all IT MUST BE RELIABLE.

LKB 2070 ULTRORAC^{R} II fraction collector is designed to meet the needs of the modern chromatographer and benefits from LKB's 20 years experience in designing and manufacturing fraction collectors.

Users of LKB 7000 ULTRORAC^{R} will recognise many features in this latest development. However, the use of all solid-state components and the inclusion of many new features, makes 2070 ULTRORAC II a more flexible instrument, while maintaining the intrinsic RELIABILITY.

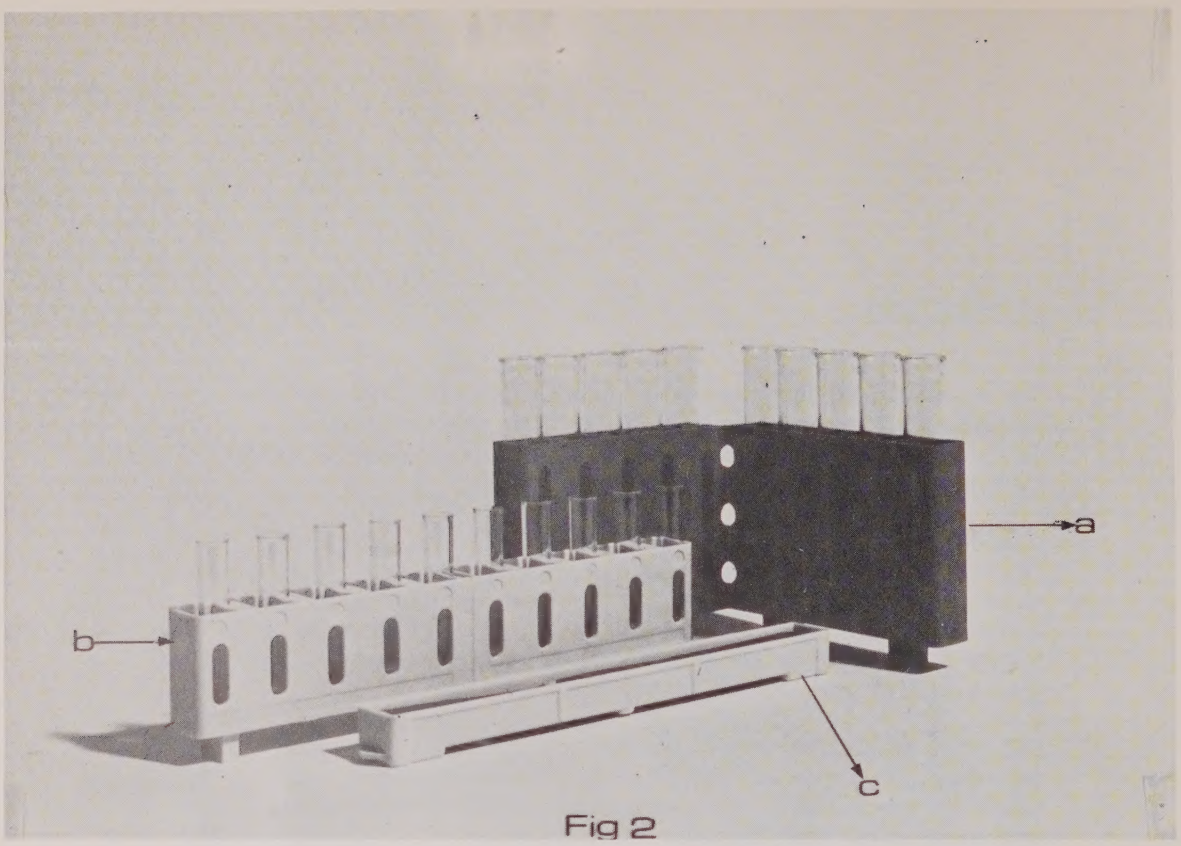


Fig 2

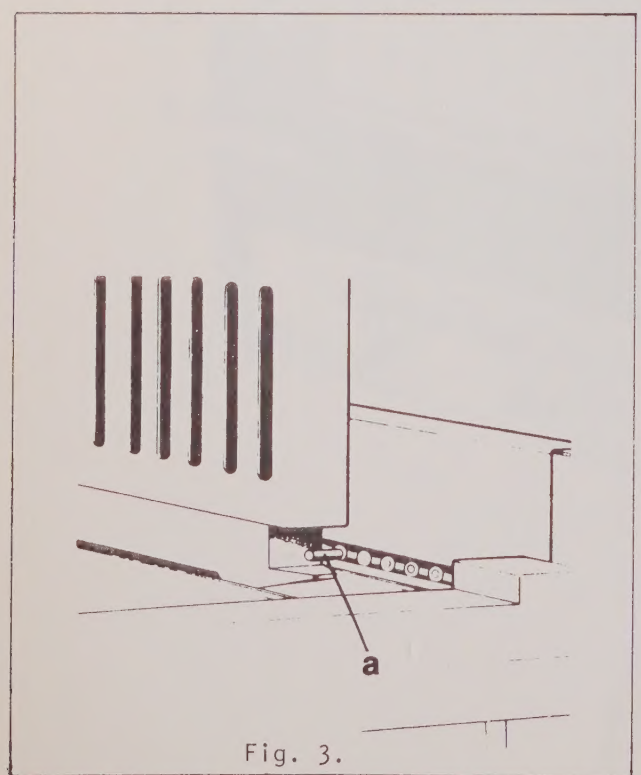


Fig. 3.

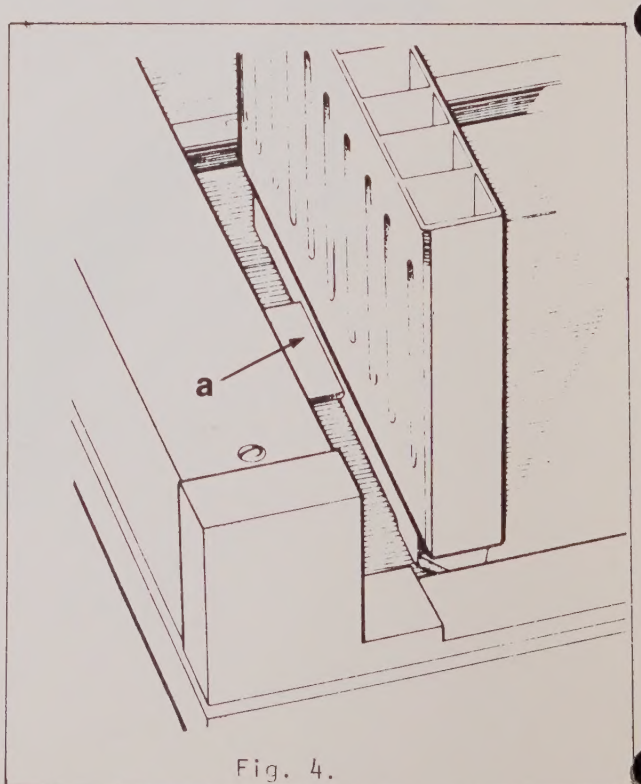


Fig. 4.

PHYSICAL DESCRIPTION

This instrument is a single unit consisting of four major functional parts:

a. The Collection Platform. fig. 1 (a)
b. The Drop-Counter Head. fig. 1 (b)
c. The Control Panel. (fig.5)
d. The Rear Panel. (fig.6)

Collection Platform - fig. 1

Test-tubes (c) are carried in TUBE-RACKS (d), each rack accommodating 10 tubes. Two types of Tube-Rack are available. The STANDARD rack (fig. 2(a) accepts tubes with diameters of 13 - 18 mm, while the alternative rack (fig. 2(b) accepts tubes having diameters of 8 - 13 mm. Each tube position in the Tube-Rack is numbered. The Tube-Racks are mounted into RACK-CARRIERS (fig. 2(c)).

Twenty Rack-Carriers must be positioned on the collection platform but only the desired number of Tube-Racks need be used.

The Rack-Carriers containing the Tube-Racks are progressed under the fixed DROP-COUNTER HEAD (Fig.1(b)). This longitudinal movement is accomplished by a motor driving a chain, onto which are attached a number of driving-pins. The driving-pins fig. 3 (a) locate behind the rear edge of each Rack-Carrier and glide the Rack-Carrier forward.

When a complete Tube-Rack has passed under the DELIVERY HEAD, a separate motor provides a transverse movement, through two pusher-bars fig.4 (a), pushing 10 racks across the collection platform, thus making space for the next Tube Rack to pass under the DROP-COUNTER HEAD.

Four stainless-steel rods (Fig.1), two on each side of the collection platform, are used to position two transparent dust-covers (f) above the collected samples in order to prevent contamination. The longest rod (g) can also be used to mount the chromatography column and the UV-monitor. The DROP-COUNTER HEAD is also located on one of the rods.

THE DROP-COUNTER HEAD - fig. 1(b)

This unit serves as the delivery head for all three collection modes and acts as the sensing head when fractions are collected by the drop-counting method. The drop-counter operates on a photo-electric principle, each falling drop momentarily breaking a light beam emitted by a diode and generating a pulse. This pulse is shaped and amplified, and used to actuate the counters. A DROP NOZZLE (i) with an internal diameter of 1.0 mm is supplied.

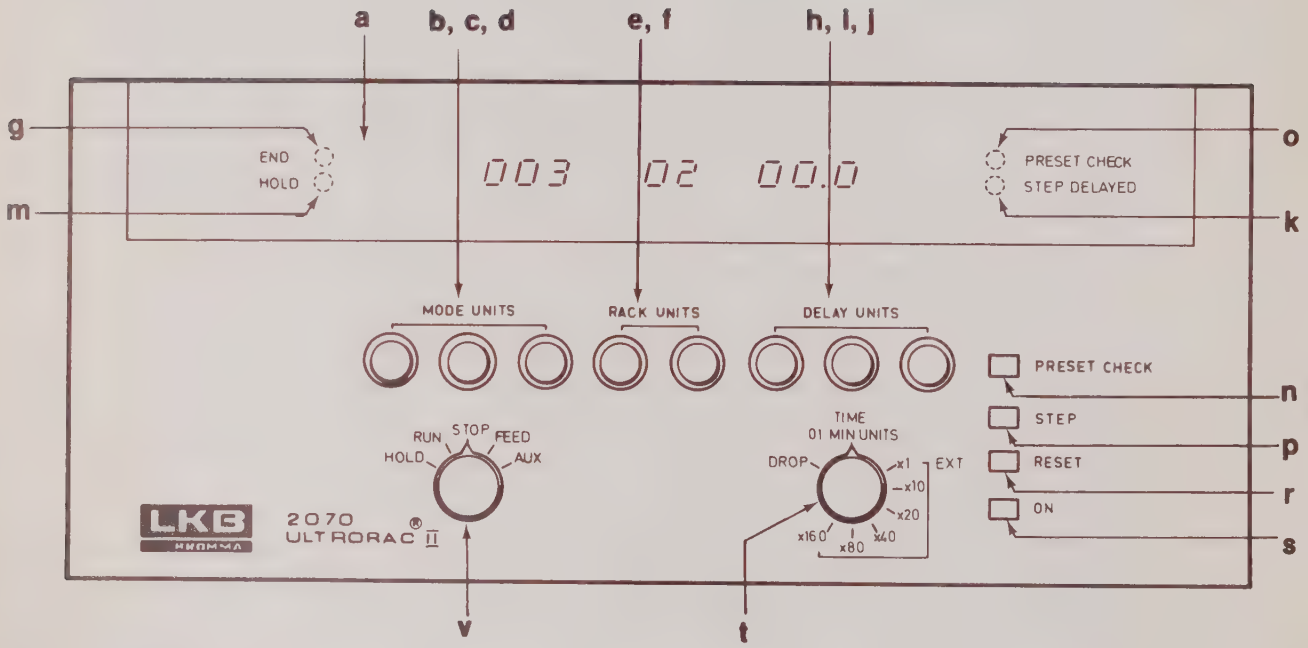

a
b, c, d
e, f
h, l, j
g
m
END
HOLD
003
02
00.0
PRESET CHECK
STEP DELAYED
o
k
MODE UNITS
RACK UNITS
DELAY UNITS
PRESET CHECK
STEP
RESET
ON
n
p
r
s
RUN
STOP
FEED
HOLD
AUX
TIME
01 MIN UNITS
DROP
x1
x10
x20
x40
x80
x160
EXT
LKB
2070
ULTRORAC II
v
t

Fig. 5.

CONTROL PANEL - fig. 5

The eight-digit LED (light emitting diode) display (a) is divided into three readout groups and gives:

1) an ACTUAL (accumulated) Display
2) a display of PRESET VALUES for:

'Mode Units' - 3 digits
'Rack Units' - 2 digits
'Delay Units'- 3 digits

MODE UNITS

Pre-set controls (b,c and d) determine the fraction size in terms of time units, number of drops or number of signals from any external source (e.g. signals from an LKB 2120 VarioPerpex II Pump). See Collection Mode Control (page 11). The MODE UNIT range is 0 - 999. When the actual value equals the pre-set value, ULTRORAC II positions the next empty tube under the drop-counter head and zeros the ACTUAL value.

RACK UNITS

Since there are 10 tubes per rack, the total number of tubes to be processed can be expressed as a number of Racks. Using controls (e and f) the desired number of racks, in the range 0-99, can be preset. Once the last rack has passed under the drop-counter head, the actual RACK UNITS will equal the preset value and the END lamp (g) will signal that fraction collecting is complete.

DELAY UNITS

This delay compensates for the error caused by the volume of eluate in the tubing connecting the UV-detector to the delivery-head of the fraction collector. The delay can be preset using controls (h,i,j) in terms of time units, number of drops or number of signals (e.g. signals from an LKB VarioPerpex II Pump). See Appendix C 'Calibrating Delay Volume'. The volume of eluate delivered to the 1st tube is equal to the volume corresponding to the MODE UNITS, plus the volume corresponding to the DELAY UNITS. Thereafter, only the MODE UNIT volume is deliverd to each tube.
The STEP DELAYED pilot lamp (k) indicates when the delay is in operation.

INSTRUMENT MODE CONTROL - fig. 5 v.

This is the master control which dictates the state of the instrument.
Position HOLD - all counting perameters are held at their actual value but any external equipment continues to operate i.e. a pump. The HOLD pilot lamp (Fig.5 m) indicates the instrument is in the HOLD condition.

Position RUN - all functions operate and collecting progresses according to the PRSET values.

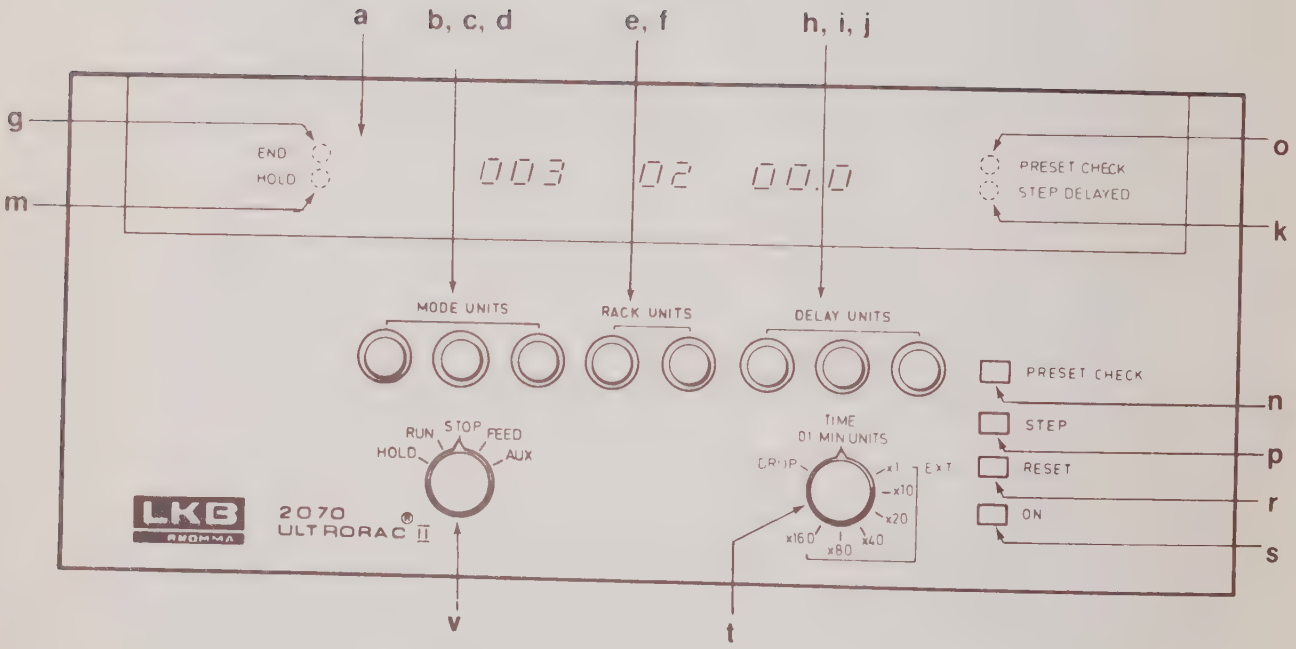

a
b, c, d
e, f
h, i, j
g
m
END
HOLD
003
02
00.0
PRESET CHECK
STEP DELAYED
o
k
MODE UNITS
RACK UNITS
DELAY UNITS
PRESET CHECK
STEP
RESET
ON
n
p
r
s
RUN
STOP
FEED
HOLD
AUX
TIME
01 MIN UNITS
GRIP
x1
x10
x20
x40
x80
x160
EXT
LKB
ULTRORAC II
2070
v
t

Fig. 5

Position STOP - all functions STOP at the actual value and external equipment is also stopped.

Position FEED - one complete rack is rapidly fed past the delivery head. During this movement external equipment e.g. a pump, will not operate but once the feeding has stopped, the pump will start again. (Feed only functions when there is a rack under the delivery head)

Position AUX - in this position all functions of the instrument can be controlled by signals from an external source entering via the 25-pole socket on the rear panel (fig. 6 a).

COLLECTION MODE CONTROL - fig 5 t

Fractions may be collected either by TIME, DROPS or PUMP CONTROL.

TIME - in this mode a decimal point appears on the MODE UNIT display (fig. 5 a), dividing the display into minutes and tenths of a minute. The minimum time interval is 0.1 min. and the range is 0.1 - 99.9 min.

DROP - the DROP-COUNTER HEAD is now in operation. The maximum counting speed is 12 drops/s and the counting range is 1 to 999 drops.

EXT - signals from an EXTERNAL source control the fraction movement.

This is an extremely accurate method for collecting PRECISE VOLUME fractions. Each pulse from an LKB 2120 VarioPerpex II corresponds to a finite volume displaced by the pump head. The EXT. position on the control panel (Fig.5) acts as an electrical gearbox, increasing the volume delivered for each unit selected on the MODE UNIT control, e.g. if the x1 position is selected, then each unit on the MODE UNIT range corresponds to the volume delivered for ONE signal from the pump. If now the x20 positions is selected, then the volume delivered is increased 20 fold.

When PUMP CONTROL is chosen as the method for collecting fractions and determining the delay volume, the same position on the EXT. range must be used. See Appendix C 'Calibrating Delay Volume'.

The volume delivered by the pump is dependent upon:

a) the size of tubing used,
b) the condition of the tubing,
c) the pressure applied when setting-up the pump.

It is, therefore, necessary to calibrate the pump to determine the volume delivered for each signal. See Appendix B, 'Pump Calibration'.

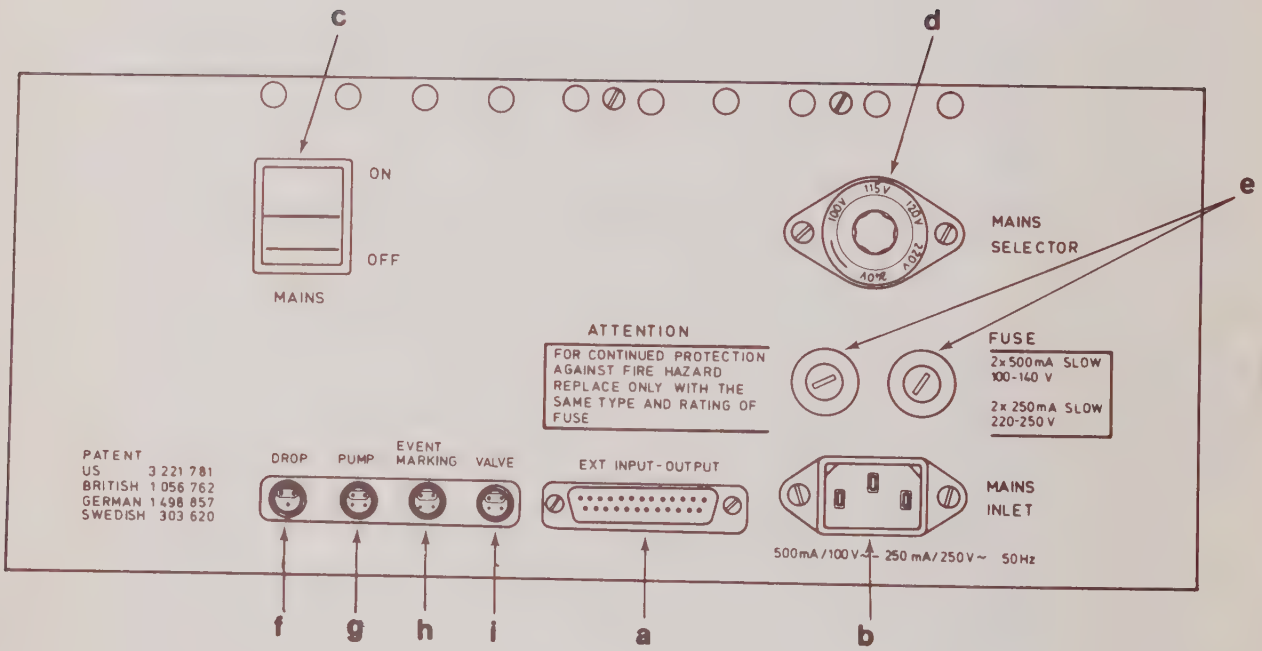

c
d
e
ON
OFF
MAINS
MAINS
SELECTOR
ATTENTION
FOR CONTINUED PROTECTION
AGAINST FIRE HAZARD
REPLACE ONLY WITH THE
SAME TYPE AND RATING OF
FUSE
FUSE
2x500mA SLOW
100-140 V
2x250mA SLOW
220-250 V
PATENT
US 3 221 781
BRITISH 1 056 762
GERMAN 1 498 857
SWEDISH 303 620
DROP
PUMP
EVENT
MARKING
VALVE
EXT INPUT-OUTPUT
MAINS
INLET
500mA/100V~ 250 mA/250V~ 50Hz
f
g
h
i
a
b

Fig. 6

PRESET CHECK - Fig. 5(n)
When this switch is depressed, the preset values of MODE UNITS, RACK UNITS and DELAY UNITS are displayed. It may be used any time during the collection cycle without affecting the accumulated values. A pilot light indicates when PRESET CHECK has been selected (Fig. 5(o)).

STEP - Fig. 5(p)
Resets the accumulated MODE UNIT display to zero and steps the tube-rack one position, if the DELAY UNIT is preset to zero. If there is a preset delay value then the STEP will occur after the delay period.

RESET - Fig. 5(r)
Cancels all accumulated values on the display, but does NOT cancel the preset values. When the END light (g) indicates the completion of a collecting cycle, then RESET must be depressed before the next collection can begin.

ON - Fig. 5(s)
Switches On and Off the low voltage powering the electronic logic circuits, when the MAINS voltage switch on the rear panel is in the 'ON' position.

REAR PANEL - Fig.6

All electrical connections are made to the rear panel of the instrument and are as follows:

MAINS INLET SOCKET (b)

MAINS ON/OFF SWITCH (c)

MAINS VOLTAGE SELECTOR (d)

TWO FUSE HOLDERS (e) - The correct rating for the fuses depends upon the mains voltage in use. See 'Installation'.

EXT.INPUT-OUTPUT (a) - Via this socket all functions of the instrument can be operated from external signal sources when the INSTRUMENT MODE CONTROL is in the AUX position all function signals are available at the EXT.INPUT-OUTPUT socket and can be used,for example, to control a second fraction collector.

DROP (f) - The cable from the DROP COUNTER HEAD is connected to this socket.

* PUMP (g) - To this socket it is possible to connect:

EITHER an LKB VarioPerpex II Pump via Connecting Cable 2040-105 (supplied with pump) when:
a) the fraction collector can be controlled by signals from the pump. See 'Collection By Pump Control' in 'Operation'.

*See table on page 19 for connection of accessory equipment to LKB 2070 UltroRac II

Fig. 7

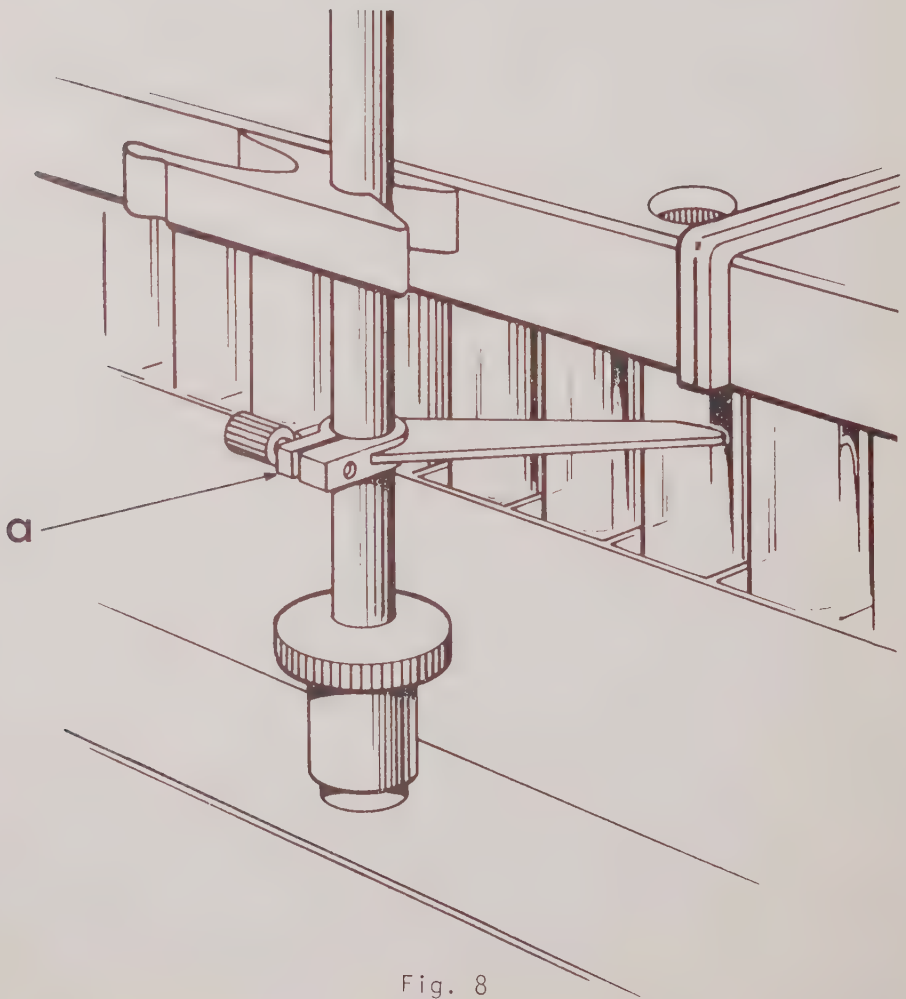


Fig. 8

b) during tube-changes, a control signal from the fraction collector, momentarily stops the pump.

OR any pump via Adapter Cable 2040-103 or -104, depending upon mains voltage in use, when:

a) the pump will stop during tube-changes

b) the pump will stop at the end of the collection cycle.

The above functions operate on all three collection modes.

*EVENT MARKING (h) - During tube-changes a D.C. signal is available to provide an event mark to a recorder, (fig.11) indicating where tube-changes have occurred.

*VALVE (i) - An LKB Flow Stopper Valve can be controlled from this socket via Adaper Cable 2040-103 or -104 Fig.13. During tube-changes the valve stops the flow of eluate to prevent loss of sample between the tubes. At the end of the collection cycle the valve closes to protect the column.

ADDITIONAL EQUIPMENT SUPPLIED

Two RACK TRAYS are supplied for the convenient handling of fractions after collection, (Fig.7). Each RACK TRAY holds 10 tube racks (100 fractions).
The instrument is supplied with an APPARATUS MAST which can be extended if required (Fig. 1(g)). See Spare Parts Catalogue.

The GUIDE ARM (Fig. 8(a)). should be mounted below the drop counter head and positioned so that all racks take up the same position under the drop counter head.

MAINS FAILURE

When power is resumed after a mains failure of up to 12 hours duration, the following sequence occurs,

a) the actual MODE UNITS are reset to zero,
b) the actual RACK UNITS value remains at the value prior to the mains failure,
c) the actual DELAY UNITS are reset to zero,
d) the instrument will STEP on one position but only after the duration of the DELAY, if the STEP DELAYED pilot light is illuminated.

*See table on page 19 for connection of accessory equipment to LKB 2070 UltroRac II.

ATTENTION
FOR CONTINUED PROTECTION
AGAINST FIRE HAZARD
REPLACE ONLY WITH THE
SAME TYPE AND RATING OF
FUSE

Fig. 9

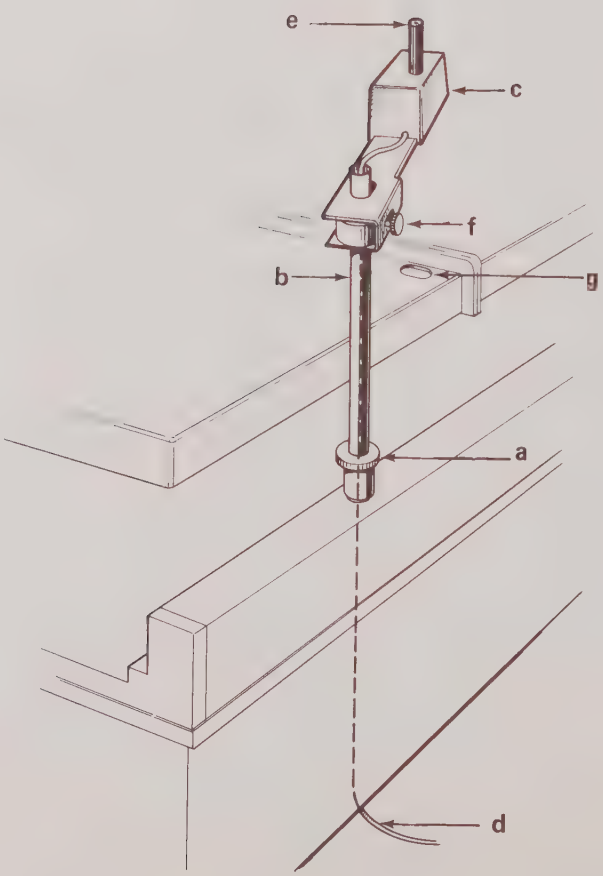

e
c
f
b
g
a
d

Fig. 10

INSTALLATION

Remove the main unit from the polystyrene carton and place it on the bench, with the REAR PANEL facing you.

1. CHECK THAT THE MAINS SELECTOR (Fig.6(d)) IS SET TO THE CORRECT MAINS VOLTAGE. To adjust the voltage selector, remove the control circuit breaker (twist and pull) (Fig.9), insert a coin into the slots and set the RED INDICATOR to the correct voltage. Replace circuit breaker.

2. Insert two fuse holders fitted with correct rated fuses (Fig.6(e)).

3. Check that the mains ON/OFF switch is in the OFF position (Fig.6(c)). Connect one end of the mains cable to the mains voltage supply and plug the other end into the mains input socket (Fig.6(b)).

4. Place 20 RACK-CARRIERS on the collection platform. The rack carriers should be arranged so that the ridges all have the same position.

5. Place the TUBE-RACKS into the RACK-CARRIERS ensuring that the slots on the tube-racks engage with the ridges on the rack-carrier. The orange 'STARTER-RACK' should be positioned so that when the INSTRUMENT MODE CONTROL is switched from STOP to RUN the rack will come into the delivery position.

6. Screw the two threaded rods (e) and (j) (Fig.1), into the positions indicated.

7. Release LOCKING SOCKET (Fig.10(a)) and insert the hollow drop counter support (b). Tighten the locking socket.

8. Mount the DROP-COUNTER HEAD (c) onto support (b), so that the hole in the drop-counter head is directly over the first tube position (g). Secure the drop-counter head with screw (f).

9. Thread the cable (d), from the drop-counter head, through the support (b) until it emerges from the base of the unit. Pull the cable through and plug into the DROP socket on the REAR PANEL (Fig.6(f)).

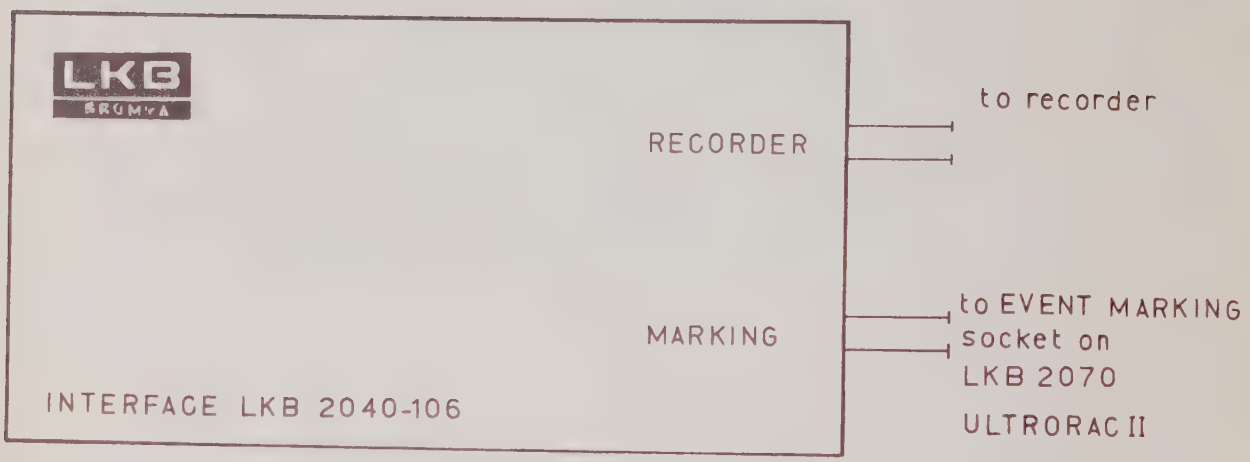
10. Insert the DROP NOZZLE (Fig. 10(e)) into the drop-counter head.

11. Release the LOCKING SOCKET on the opposite side of the collection platform and insert the APPARATUR MAST (Fig.1(g)). Tighten the locking socket.

12. Position the DUST-COVERS (Fig. 1(f)) above the tube-racks.

THE INSTRUMENT IS NOW READY FOR USE.

Event Marking Interface 2040-106
Schematic Diagram



Event Marking Interface 2040-106
Circuit Diagram

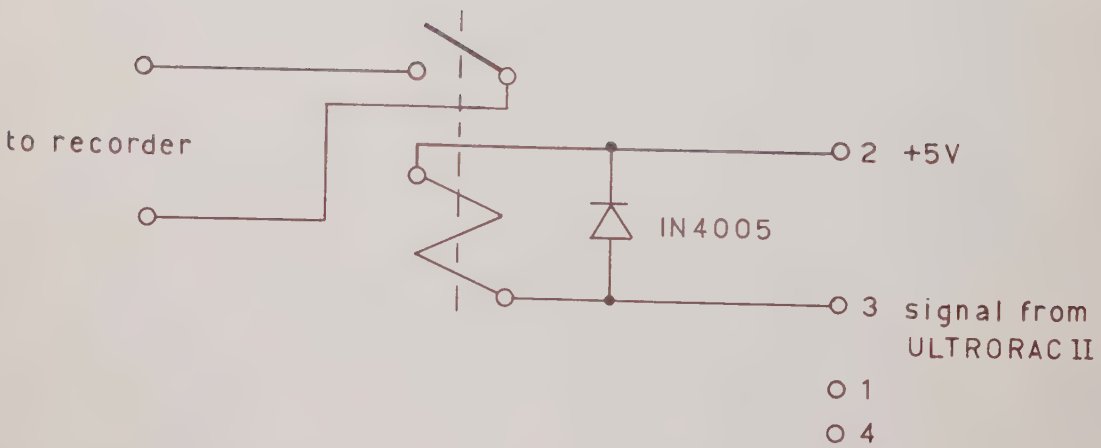
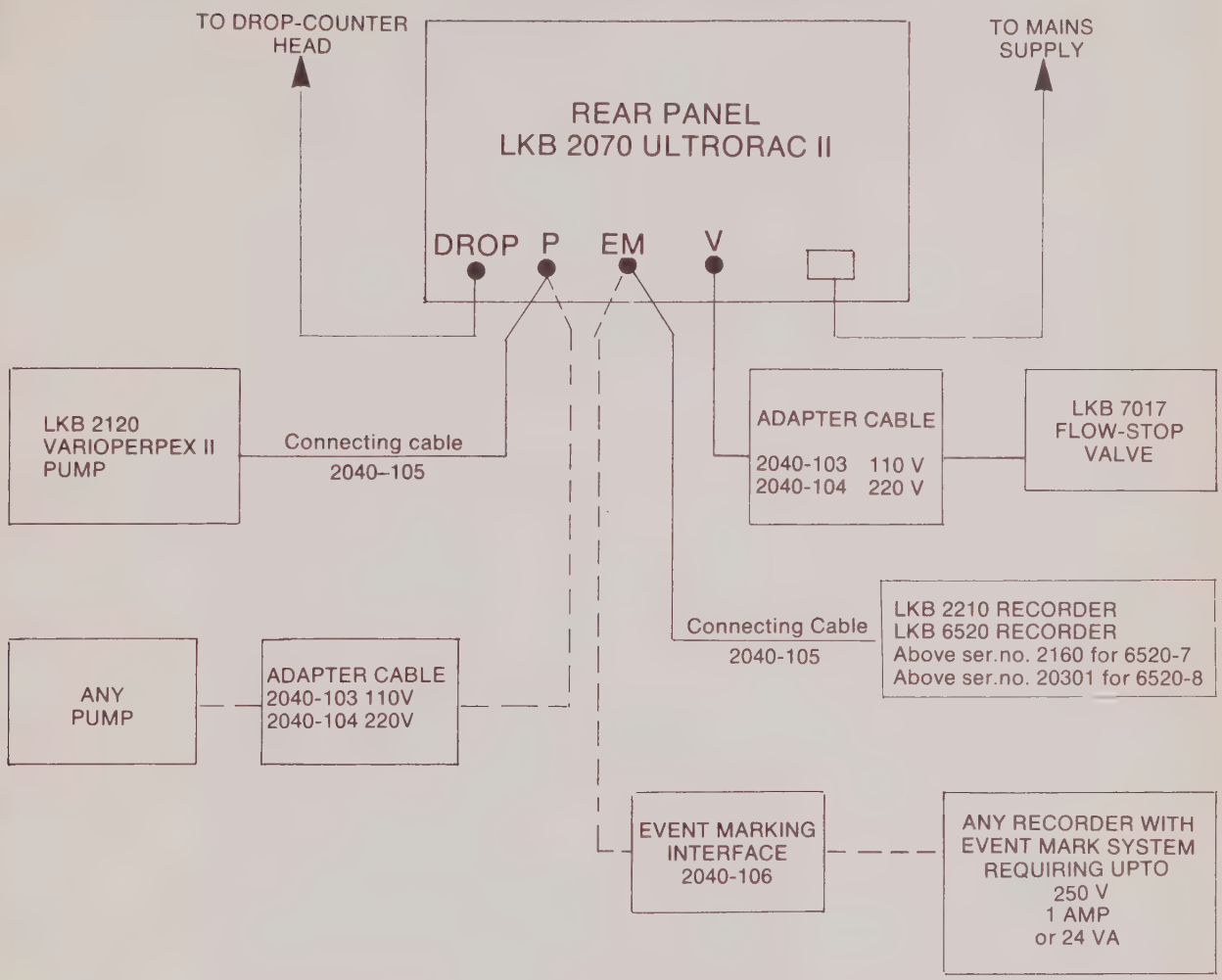


Fig. 11

Connection of Accessory Equipment to LKB 2070 UltroRac II



Cables for connecting 2070 UltroRac II to accessory equipment

Accessory	Cable required
LKB 2120 VarioPerpex II Pump	LKB 2040-105 Connecting cable (supplied with pump)
Any other LKB pump *or* other make of pump *or* LKB 7017 Flow Stopper Valve	Either: LKB 2040-103 Adapter cable for 110V, 60 Hz or: LKB 2040-104 Adapter cable for 220V, 50 Hz (Provides flow-stop and shut-down functions)
LKB 2210 Recorder LKB 6520 Recorder	LKB 2040-105 Connecting cable (supplied with recorder)
Any other Recorder requiring up to 250V, 1A and a max. load of 24VA to operate the event marking system.	LKB 2040-106 Event marking interface

Fig. 12

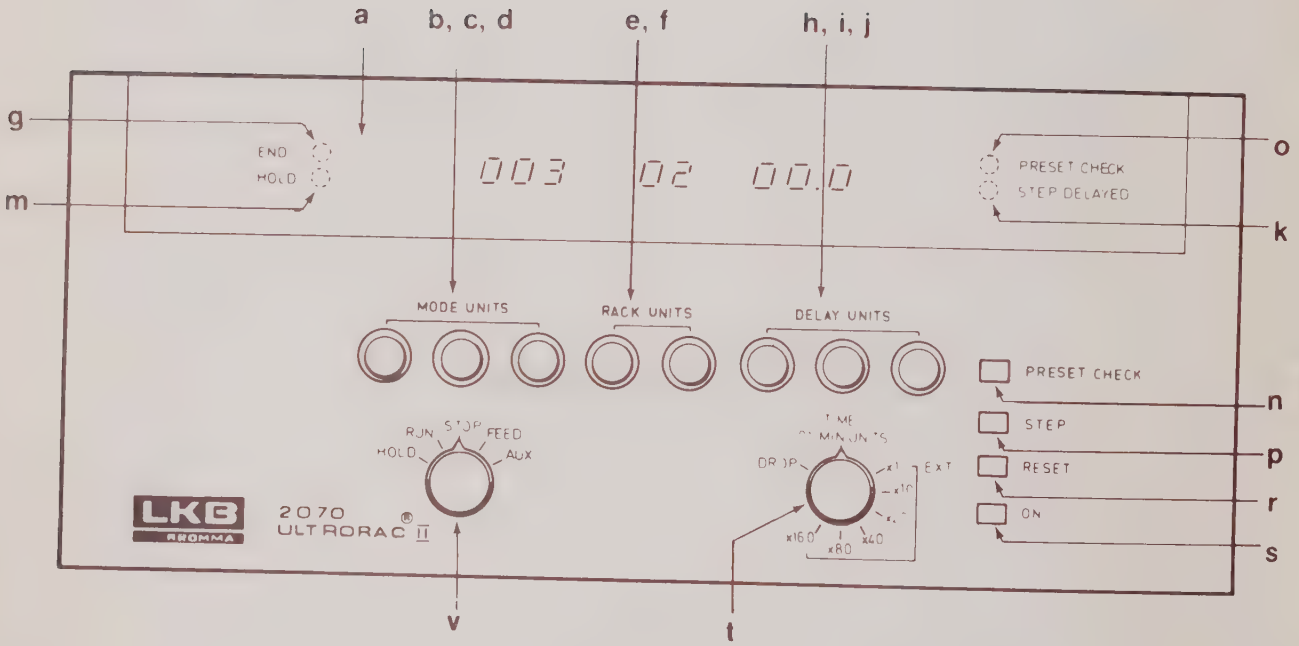

a
b, c, d
e, f
h, i, j
g
m
END
HOLD
003
02
00.0
PRESET CHECK
STEP DELAYED
o
k
MODE UNITS
RACK UNITS
DELAY UNITS
PRESET CHECK
STEP
RESET
ON
n
p
r
s
RUN
STOP
FEED
HOLD
AUX
DROP
EXT
x16.0
x8.0
x4.0
LKB
ÅKROMMA
2070
ULTRORAC II
v
t

Fig. 5

OPERATION

The first section of these operation instructions is intended to:

a) enable you to become familiar with the various controls and functions of the instrument,

b) allow you to satisfy yourself that the instrument is in a fully operational condition.

1. Set the mains ON/OFF switch to ON (rear panel,Fig.6(c)).

2. Depress the ON switch (Fig.5(s)).
   The display will now be illuminated, showing eight zeros. Closer examination will show that there is a decimal point after the first zero on the MODE UNITS and DELAY UNITS display. This indicates that TIME has been selected on the COLLECTION MODE CONTROL (t). Check this.

3. Depress PRESET CHECK (n).
   You will now see on the display, 00.3 02 00.0

   This indicates:
   a) that 3 units have been preset on the MODE UNITS and since COLLECTION MODE CONTROL (t) is in the TIME position, this gives a fraction time of 3 tenths of one minute.

   b) that 2 racks have been preset on the RACK UNITS, i.e. 20 fractions are to be collected.

   c) that the DELAY units have been preset to zero, i.e. the delay funtion is not in use.

   In other words, you are looking at a display of the PRESET VALUES. Notice that the PRESET CHECK pilot lamp (o) is illuminated.

4. Release the PRESET CHECK switch (n)
   The display will again show eight zeros and the PRESET CHECK pilot lamp (o) will extinguish.
   You are now in a position to check the operation of the instrument.

5. Switch the INSTRUMENT MODE CONTROL (v) from STOP to RUN.
   After one tenth of a minute (6 s.) the figures 00.1 will appear on the display above MODE UNITS. After a further 6 s. 00.2 will appear.

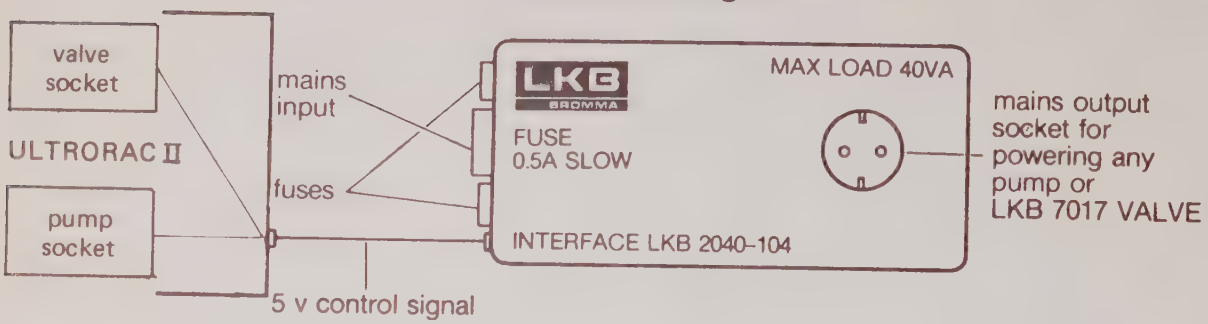
   Your are looking at an ACTUAL (accumulated) display of MODE UNITS.

   When the third period of 6 s. is complete, the ACTUAL VALUE will equal the PRESET VALUE and the following sequence will occur:

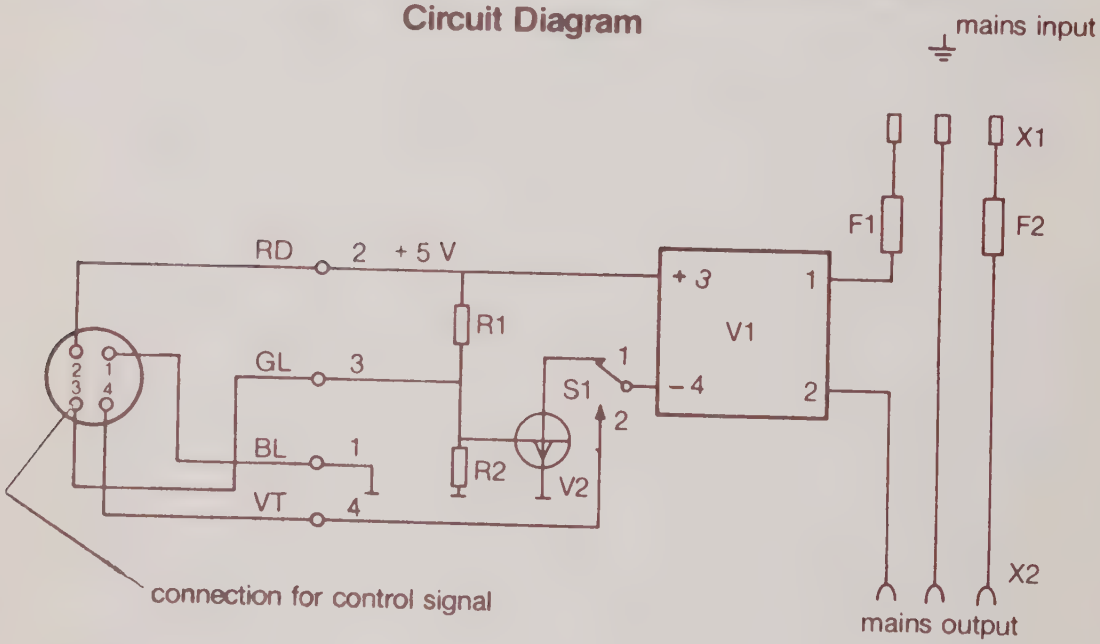
   a) the actual MODE UNITS display is zero set. (figures 00.3 are not displayed because the electronic circuits operate so fast).

   b) the tube-rack advances one position and places a new tube under the delivery head. i.e. a TUBE-CHANGE has occurred. During the tube-change, the display is held at zero.

LKB Adapter Cable with Interface 2040-103 and 2040-104
Schematic Diagram



LKB Adapter Cable with Interface 2040-103 and 2040-104
Circuit Diagram



NOTE! F1, F2 and mains socket outlet are the only differences between 2040-103 and 2040-104.

Fig. 13

The above sequence will now be repeated 10 times as the first tube-rack is progressed under the delivery head. After the tenth tube-change (i.e. ONE COMPLETE RACK) the figues '01' will appear on the RACK UNITS display.
When the second rack has passed under the delivery head, the actual value of RACK UNITS will equal the preset value. The END pilot lamp (g) on the display will come on, indicating the collection cycle is complete.

6. Return the INSTRUMENT MODE CONTROL (v) to the STOP position.

7. Depress RESET switch (r).
Notice that the END lamp (g) is now extinguished.

Should you wish to check the other functions of the instrument, turn to the 'Control Panel' section on page 9.

You are now in a position to put the instrument into immediate use. However, you must first decide what MODE of fraction collecting is to be used. Appendix (A) 'Factors affecting fraction volume' may help you to choose the correct collecting MODE for your application.

COLLECTION BY TIME

1. Connect the pump to the fraction collector (Fig.12).

2. Remove the dust-covers.

3. Load test-tubes into the tube-racks corresponding to the number of fractions to be collected.

4. Replace the dust-covers so that they are positioned 1 to 2 cm above the test-tubes.

5. Release LOCKING SOCKET (Fig.10(a)) and adjust the height of the DELIVERY HEAD (c) to 0.5 cm above the dust-cover.
Remove the drop nozzle (e) from the delivery head (c) and visibly check you are over the first tube position. Release screw (f) and adjust if required.

6. Connect the delivery tubing to the drop nozzle. Make sure you have a tight connection. Replace the drop nozzle into the delivery head.

7. Set INSTRUMENT MODE CONTROL Fig. 5(v) to STOP.

8. Set COLLECTION MODE CONTROL (t) to TIME.

9. Depress PRESET CHECK (n).

10. Using controls (b,c and d) under MODE UNITS, set the fraction interval on the display, See TIME on page 11.

11. Using controls (e and f) under RACK UNITS, set the total number of racks to be processed. See RACK UNITS on page 9.

Pilot lamp
CW/STOP/CCW
switch
×1/×10 switch
Max-flow override
Flow-rate control
On/off switch
Remote control
connection
SPEED
LKB

Fig. 14

12. Using controls (h,i and j)under DELAY UNITS, set the calibrated delay volume on the display. See Appendix C 'Calibrating Delay Volume'. If delay is not to be used set display to '000'.

13. Release PRESET CHECK (n).
(if an LKB 2120 VarioPerpex II pump is used, set CW/STOP/CCW switch to CW or CCW (Fig. 14)).

14. Switch 'ON' the pump. (The pump will not operate because the INSTRUMENT MODE CONTROL (v) is in the STOP position).

15. Depress RESET if display is NOT at zero.

16. Move INSTRUMENT MODE CONTROL (v) from STOP to RUN.

COLLECTION OF FRACTIONS HAS STARTED.

COLLECTION BY DROP-COUNTING - Fig.5

Follow steps 1 - 7 on page 23.

8. Set COLLECTION MODE CONTROL (t) to DROP.

9. Depress PRESET CHECK (n).

10. Using controls (b,c and d) under MODE UNITS, set the number of drops per fraction.

11. Using controls (e and f) under RACK UNITS, set the total number of racks to be processed. See RACK UNITS on page 9.

12. Using controls (h,i and j) under DELAY UNITS, set the calibrated delay volume on the display. See Appendix C 'Calibrating Delay Volume'. If delay is not to be used set display to '000'

13. Release PRESET CHECK (n).

Follow steps 14 - 16 on page 25.

Collection of fractions starts when the first drop passes through the DROP COUNTER HEAD.

COLLECTION BY PUMP CONTROL - Fig.5

This mode of collection can be accomplished by using any suitable external signal source but these instructions assume that an LKB 2120 VarioPerpex II Pump is used.

Follow steps 1 - 7 on page 23.

8. Set COLLECTION MODE CONTROL (t) to the desired EXT. range. See PUMP CONTROL (Page 11). The same position on the EXT. range must be used for both MODE UNITS and DELAY UNITS.

9. Depress PRESET CHECK (n).

10. Using controls (b,c and d) under MODE UNITS, set the fraction size on the display. (In order to do this you must know the volume delivered by the pump for each unit on the MODE UNITS range, i.e. you must calibrate the pump). See Appendix B 'Pump Calibration'

11. Using controls (e and f) under RACK UNITS, set the total number of racks to be processed. See RACK UNITS (page 9).

12. Using controls (h,i and j) under DELAY UNITS, set the calibrated delay volume on the display. See Appendix C 'Calibrating Delay Volume'. If delay is not to be used set display to '000'

13. Release PRESET CHECK (n)

Follow Steps 14 - 16 on page 25.

END OF RUN - Fig. 5

When the collection cycle is complete (i.e. the number of racks processed equals the preset value of RACK UNITS), the END pilot lamp (g) will come on.

1. Return the INSTRUMENT MODE CONTROL (v) to STOP.

2. Depress the RESET switch (r)

3. Remove Dust Covers.

4. Lift off the tube racks containing the collected fractions and place them in the RACK TRAY.

5. Replace Dust Covers.

6. Switch off the fraction collector and pump.

APPENDIX A

FACTORS AFFECTING FRACTION VOLUME

The major uses of fraction collecting are:

i) Column chromatography.including gel filtration, ion exchange, affinity and adsorption chromatography.

ii) Preparative isotachophoresis and electrophoresis, e.g. using LKB Uniphor.

iii) Elution from LKB Ampholine electrofocusing columns.

iV) Fraction of density gradients after centrifugation.

In column chromatography, a constant flow rate through the column can be provided by a Mariotte flask, which maintains a constant hydrostatic pressure. In some situations the gel matrix may swell or become packed, causing the flow rate to change. A pump is therefore more often used to maintain a constant flow rate. A pump is absolutely necessary when the contents of Ampholine electrofocusing columns are being collected, since the changing viscosity of the stabilising density gradient would, under gravity elution, produce a change in flow rate and thus change fraction volumes.

Prior to the introduction of collection by pulse control there were three methods of fraction collecting:

a) DROP COUNT FRACTION COLLECTING:
Individual drops of liquid from the end of the column delivery tubing interrupt a light beam in the delivery head of the fraction collector. When a preset number of drops has been recorded the collecting tube is changed.

Drop count collecting is mainly used for very small volumes, e.g. fractions from density gradient centrifugation tubes. A change in flow rate would not affect the fraction size, but a change in surface tension of the collected material might.

Exner, Rickard & Kronenberg, Science Tools 23, 1-3 (1976) showed that the presence of 0.1% sodium dodecyl sulphate (SDS) could reduce the drop weight of a NaCl/Tris-HCl buffer to less than 50% of the original buffer. 0.1% sodium cholate and 0.1% sodium stearate reduced the weight to 75% and 83% respectively. Thus, when comparing fractions containing a surface active agent to an identical system without, quite large changes in fraction size would be found if this phenomenon went unnoticed. Exner et al. also showed that surface-active components of the sample itself can affect fraction size when collecting by drop count: such components may occur in blood from healthy and ill subjects.

b) TIMED FLOW FRACTION COLLECTING
This method is most often used for column chromatography and similar techniques, where volumes larger than 0.5 ml are desired. The time for each fraction can be easily obtained. Because timed flow is not affected by surface tension changes, it is more dependable than drop count collection. It does require the use of a pump to maintain a constant flow rate. In some countries, gross changes in mains voltage can occur, which would alter the pump speed, and thus fraction size.

c) SYPHON COLLECTING

In this method, liquid is collected in a resceptacle with a known, fixed volume: when that volume has been reached the liquid surface creates a syphon effect through a capillary tube, and the contents of the receptacle are transferred to a collecting tube.

This method has the advantage that, provided the volume of the receptacle is known, no recalibration is necessary when changing flow rate, etc. Surface tension changes have only a slight effect on volume.

Fraction volumes cannot be changed except through replacement by another receptacle: fraction sizes are not continuously variable. There is also the problem of carryover between fractions, since viscous liquids would take a long time to drain down the walls of the receptacle. For these reasons, syphon collecting is rarely used.

The introduction of collection by pulse control using an LKB 2120 Vario Perpex II Pump creates another type of fraction collecting method - by exact volumes, which removes most of the difficulties encountered with the other methods:

- Surface tension changes will only affect the very last drop of each fraction collected: if the tubing diameter is sufficiently small, the change in fraction volume will be negligible.
- Changes in flow rate will not affect fraction volume, only the time over which it is collected.
- Small or large fractions can be collected.
- There is no carry over of adjacent fractions.

A COMPARISON OF FRACTION COLLECTING METHODS

	DROP COUNT	TIMED FLOW	SYPHON	PULSE CONTROL
Affected by change in surface tension?	YES	NO	SLIGHTLY	NO
Used for what fraction size?	Drops to 990, usually <1-2ml.	0.5-∞ ml.	1 - ∞ ml.	any size
Steps between fraction sizes	1,10 drops	o.1,1 min.	1-5 ml	max.25 µl
Pump required?	NO	YES	NO?	YES (LKB 2120 PUMP)
Dependent on flow rate?	NO,if <5 drop/s.	YES	NO,within limits (i.e. viscosity, emptying rate flow rate/vol)	NO
How many calibrations needed	1 std curve (drop no/vol)	Std curve at each flow rate (vol/time)	Need only know receptacle size.	one calibration volume per pulse.
Fraction size affected by mains changes?	NO	YES, on flow rate.	NO	NO

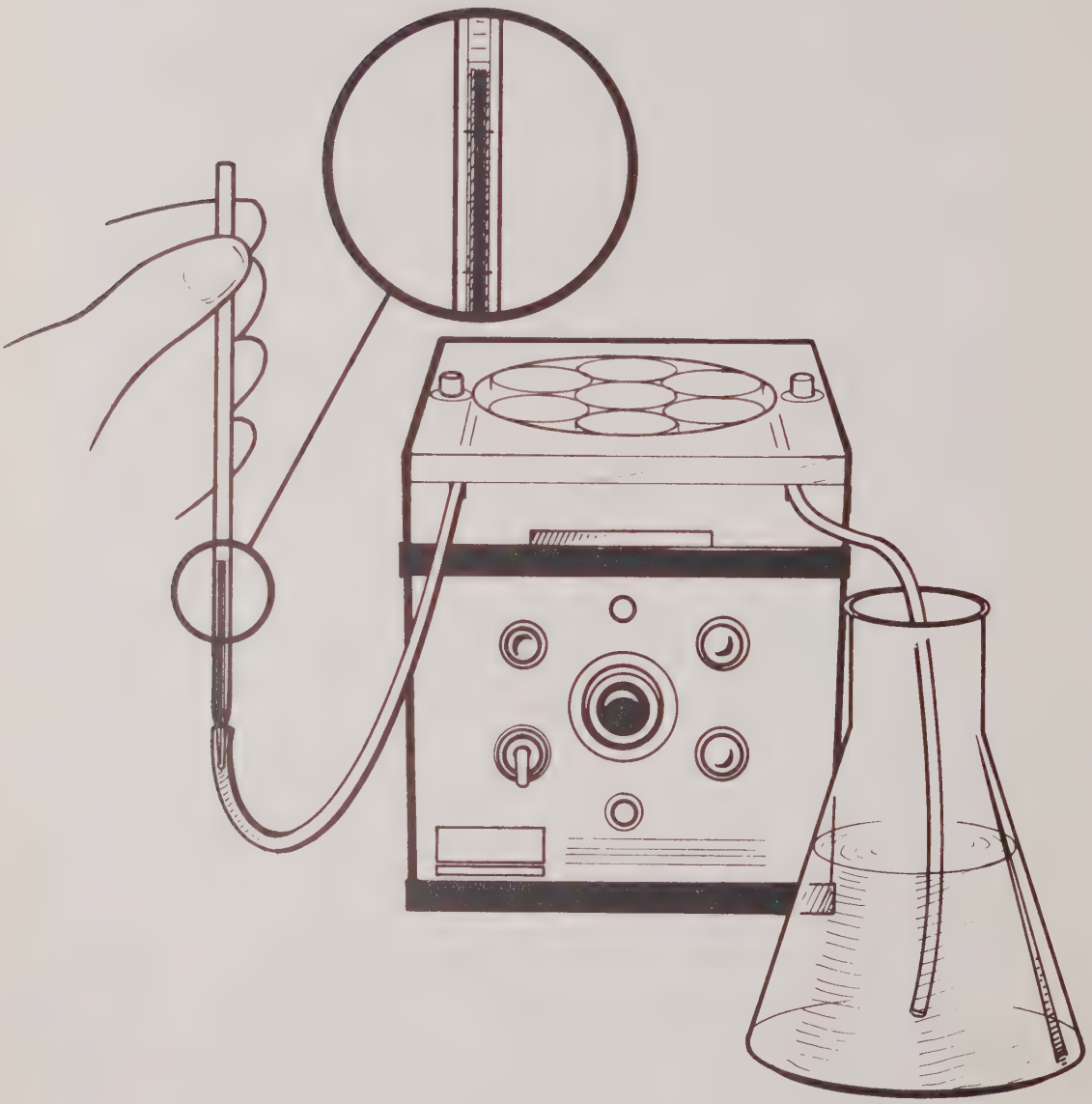


Fig. 15

APPENDIX B

PUMP CALIBRATION

During collection by PULSE CONTROL, the movement of the fraction collector is controlled by signals from an LKB 2120 VarioPerpex II Pump. In order to preset a fraction size, expressed in terms of signals, you need to know THE VOLUME DELIVERED by THE PUMP FOR EACH SIGNAL.

As explained on page 11, the volume delivered by the pump will vary slightly each time:

a) the tubing is replaced
or b) the pressure in the back-plate is adjusted.

It is therefore necessary to calibrate the pump as follows:

PUMP SETTINGS

1. Set up the pump in accordance with the pump instruction manual using 1.3 mm I.D. tubing.
2. Place one end of the tubing in a beaker of water and fill the pump tubing full of liquid (Fig.15)
3. Connect the other end of the tubing to the tip of a 1 ml graduated pipette.
4. Set the ON/OFF switch to 'ON'
5. Set the CW/STOP/CCW switch to 'STOP'
6. Set the X10/X1 switch to X10.
7. Insert one end of the Connecting Cable (2040-105) into the 'REMOTE' socket on the pump and the other end into the 'PUMP' socket on the rear panel (Fig. 6(g)) of UltroRac II.

ULTRORAC II SETTINGS -Fig.5

1. Switch ON the mains switch (Rear Panel).
2. Check INSTRUMENT MODE CONTROL is in STOP position.
3. Depress ON switch (Front Panel).
4. Depress PRESET CHECK.
5. Preset '999' on MODE UNITS.
6. Preset '01' on RACK UNITS.
7. Preset '000' on DELAY UNITS.
8. Release PRESET CHECK.
9. Set COLLECTION MODE CONTROL to X1 on the EXT. range.
10. Switch INSTRUMENT MODE CONTROL from STOP to RUN.
11. Switch CW/STOP/CCW control, on the pump, from STOP to CW.
12. When '500' appears on the MODE UNITS display, switch CW/STOP/CCW control back to STOP (by adjusting the Flow-Rate control, on the pump, you can slow-down the rate of signals so that you are able to STOP precisely on '500').
13. Read off the volume delivered.

$$\frac{\text{VOLUME DELIVERED}}{500} = \text{VOLUME PER PUMP SIGNAL}$$

In practise, the VOLUME PER PUMP SIGNAL will be approximately:

a) 0.8 MICRO LITRES when using 1.3 mm I.D. tubing

b) 3.5 MICRO LITRES when using 3.0 mm I.D. tubing

It is now a simple calculation to determine the preset value to give a chosen fraction size.

Example: If the desired fraction size is 4 ml and the VOLUME PER PUMP SIGNAL is 0.8 µl, then the preset value of MODE UNITS

$$= \frac{4 \times 1000}{0.8} = 5000 \text{ UNITS}$$

This value can be preset in a number of ways by using the different ranges on the EXT. scale but the correct setting to give the highest degree of accuracy is:

MODE UNITS	EXT. RANGE
500	x 10

14. Switch INSTRUMENT MODE CONTROL from RUN to STOP.

15. Depress RESET switch

Now return to Point 9 under COLLECTION BY PUMP CONTROL page 27.

APPENDIX C

CALIBRATING DELAY VOLUME

UltroRac II gives a 5V EVENT MARKING signal for each TUBE CHANGE. This signal can be used to relate collected fractions to peaks on the UV record. However, the volume of liquid from the UV-monitor optical cell to the delivery head of the fraction collector gives rise to an error in this identification. By using the DELAY function you can correct this error.

The DELAY function can be used with any of the three COLLECTING MODES.

CALIBRATION OF DELAY VOLUME BY TIME - Fig. 5

1. Set COLLECTION MODE CONTROL to TIME.
2. Depress PRESET CHECK.
3. Preset '999' on MODE UNITS.
4. Preset '01' on RACK UNITS.
5. Preset '000' on DELAY UNITS.
6. Release PRESET CHECK.
7. Switch on the pump.
8. Move INSTRUMENT MODE CONTROL from STOP to RUN.
9. When the leading edge of the liquid appears at the exit of the UV-monitor, switch INSTRUMENT MODE CONTROL from RUN to STOP.
10. Depress RESET switch.
11. Switch INSTRUMENT MODE CONTROL from STOP to RUN.
12. When the leading edge of the liquid arrives at the delivery head, switch INSTRUMENT MODE CONTROL from RUN to STOP.

    Note the time units on the MODE UNITS display

13. Depress RESET switch.

Now return to point 9 on page 23. COLLECTION BY TIME and continue.

CALIBRATION OF DELAY VOLUME BY DROP-COUNTING - Fig.5

1. Set COLLECTION MODE CONTROL to DROP.

Follow steps 2 - 6 above

7. Make sure the tubing from the UV-monitor to the delivery head of the fraction collector is full of liquid.
8. Introduce an air bubble in the line, before the UV-monitor. Continue pumping until the front edge of the air bubble appears at the exit of the UV-monitor. Switch INSTRUMENT MODE CONTROL from RUN to STOP.
9. Depress RESET switch.

10. Switch INSTRUMENT MODE CONTROL from STOP to RUN.

11. When the front edge of the air bubble arrives at the drop-counter head, switch INSTRUMENT MODE CONTROL from RUN to STOP.

    Note the number of drops on the MODE UNIT display.

12. Depress RESET switch.

Now return to point 9 on page 25 COLLECTION BY DROP-COUNTING and continue.

CALIBRATION OF DELAY VOLUME BY PUMP CONTROL - Fig. 5

1. The chosen fraction volume will determine which position on the EXT. range is to be used for MODE UNITS. The SAME position on the EXT. range must be used for DELAY UNITS.

Follow steps 2 - 12 page 37

Note the number of units on the MODE UNITS display.

13. Depress RESET switch.

Now return to point 9 on page 27 COLLECTION BY PUMP CONTROL and continue.

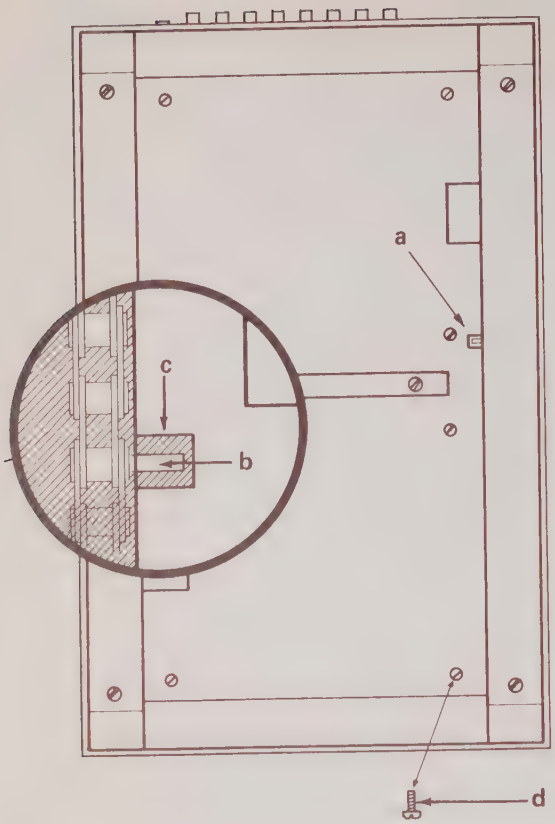


Fig. 16

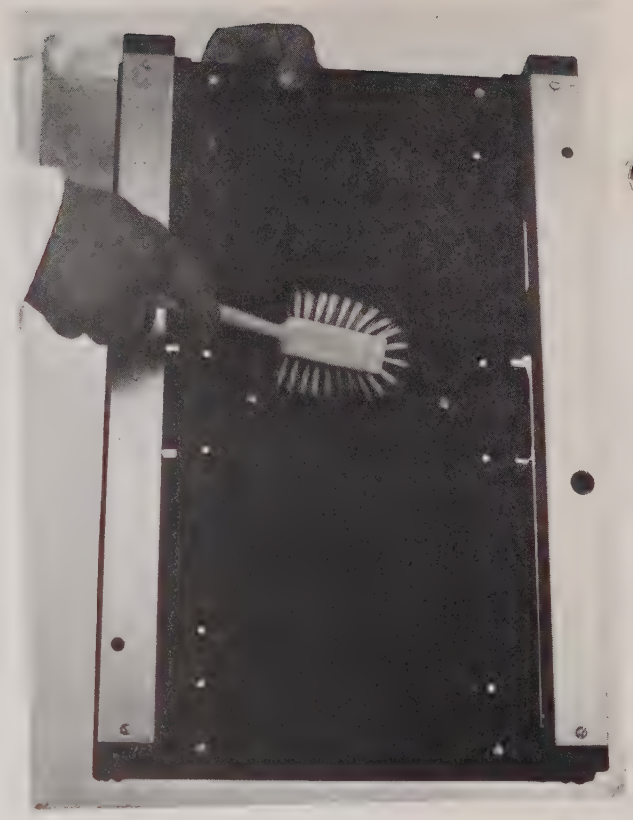


Fig. 17

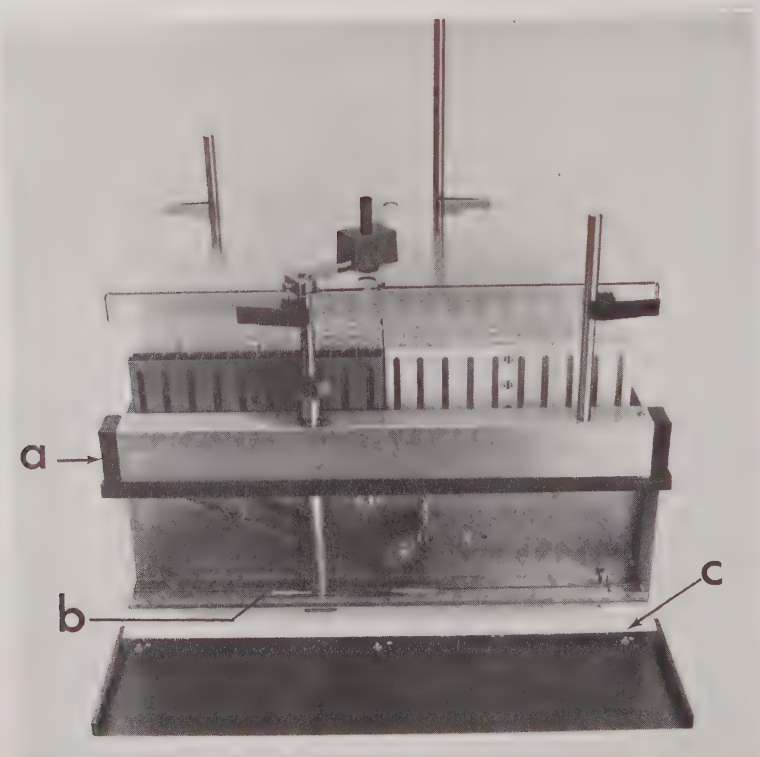


Fig. 18

APPENDIX D

MAINTENANCE

Accumulations of dehydrated buffers and dust can obstruct the free movement of the rack carriers on the collection platform and cause a mal-function. The collection platform can be removed for cleaning as follows:

1. Remove the DUST-COVERS.
2. Remove the delivery head as follows:
   a) remove the drop-counter plug from the DROP socket on the rear panel.
   b) release screw (Fig.10(f)) and draw the drop-counter cable through the support tube (Fig. 10(b)).
3. Release locking socket (Fig.10(a)) and remove drop-counter support (Fig.10(b)). Release locking socket on the opposite side of collection platform and remove apparatus mast (Fig. 1(g)). Unscrew and remove both locking sockets.
4. Unscrew and remove rods (e) and (j)(Fig.1).
5. Remove all the tube racks and rack carriers. (Wash the rack carriers in warm water, if necessary).
6. Ensure that the driving pins (a) and (b) align with the slots (c) in the collection platform (Fig.16). If necessary, use 'STEP' switch on the control panel to move the driving pins into position.
7. Pull out the mains cable from the mains supply.
8. Remove the eight screws (d) securing the collection platform to the base (Fig.16).
9. Lift off the collection platform.
   Wash the collection platform in warm water and allow to drain (Fig.17).
10. Replace the collection platform, ensuring that the slots in the side-wall align with the driving pins.
11. Replace and secure the eight screws (d) (Fig.16).

Reassemble the instrument according to the instructions under INSTALLATION (page 17).

SPILLAGE - Fig. 18.

Should buffer accidently spill over the collection platform, the liquid will pass through two holes in the collection platform (a) and out through slots in the base of the instrument (b). However, you can thoroughly remove all spillage by removing the side panels (c) as follows:

1. Remove the mains cable from the mains supply.
2. Remove three screws and take off side panel.
3. Remove spillage and replace side panel.

DROP-COUNTER HEAD

For continuous, trouble-free operation of the drop-counter head, it is important that the glass tube, passing through the center of the drop-counter head, is kept clean. Periodically, wipe the glass tube with a clean cloth (Fig. 19).

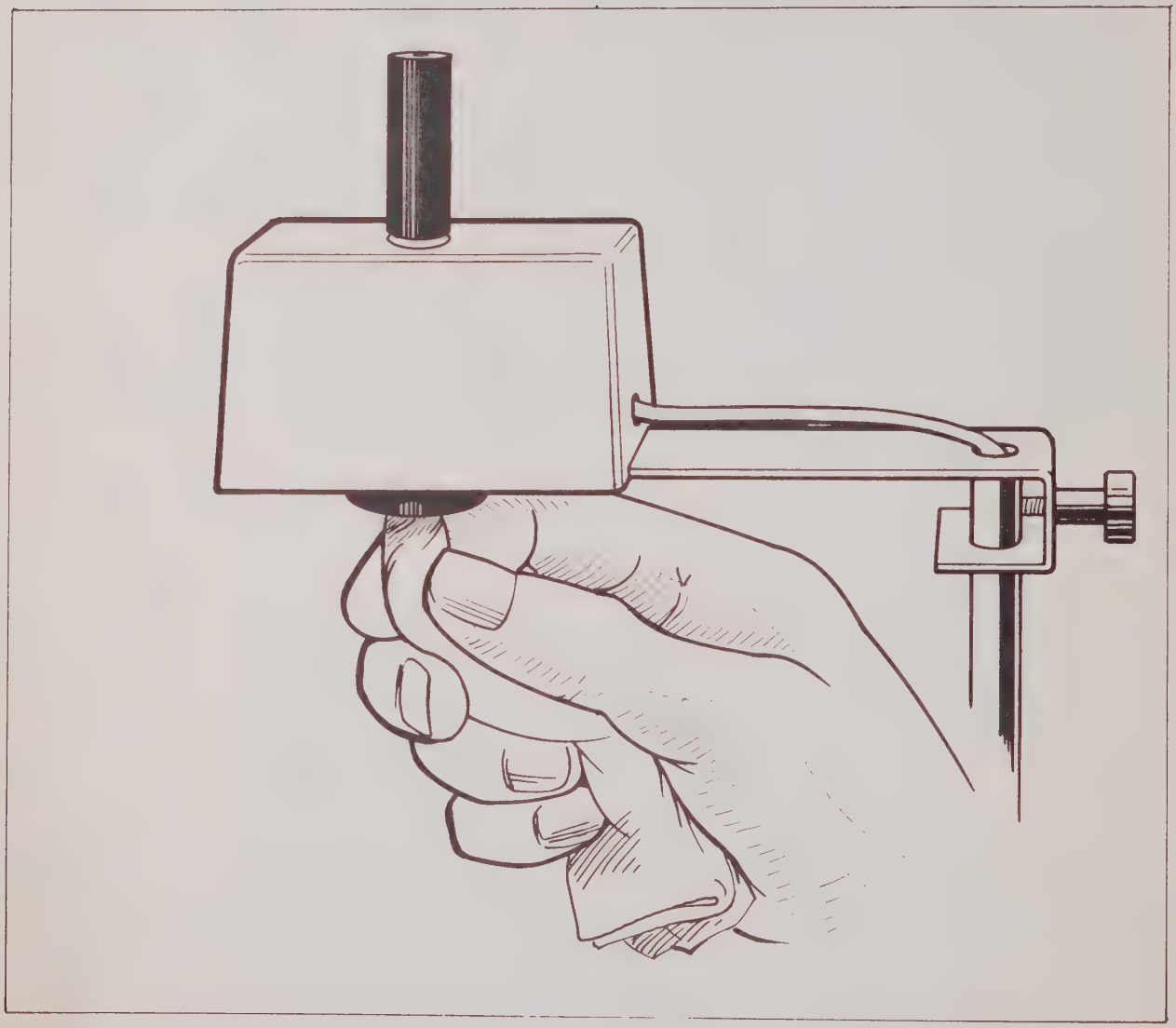


Fig. 19

APPENDIX E

TECHNICAL SPECIFICATION

Timed-flow collection	0.1 - 99.9 min. in o.1-min. intervals
Drop count collection	1 - 999 drops in 1-drop intervals
Max. drop rate	12 drops/s.
Pump control collection	With LKB 2120 VarioPerpex II Pump: 1 µl - 130 ml (1.3 mm I.D. tubing) 3.5 µl - 550 ml (3.0 mm I.D. tubing)
Step delay	Operates on all three collecting modes: for ranges see above
Tube change time	1s approx.
Number of tubes	200, in 20 racks of 10 each
Tube size	13 - 18 mm diameter (standard rack) 8 - 13 mm diameter (optional rack)
Automatic shut-down	After preset number of racks from 1 - 99
Event marking	Open collector output. for 1 s ± 10%
Operating temperature range	0 - 40°C
Mains voltage requirements	100,115,120, 220 or 240V ± 10%, 50/60 Hz
Power consumption	50W excl. auxiliary equipment
Dimensions (WxDxH)	330 x 520 x 250 mm
Net weight	19 Kg.
Gross weight	21 Kg.

LKB 2070 UltroRac II has been designed to comply with the U.S. Underwriters Laboratories standard, UL 1262, and also complies with, wherever compatible with UL 1262, the following national safety standards: VDE 0750 Pt.3 (Germany) CSA C.222 No. 151 (Canada),and SMI (United Kingdom)

APPENDIX F

EQUIPMENT SUPPLIED AND OPTIONAL ACCESSORIES

Cat. No.	Description
	Equipment supplied:
2070-001	UltroRac II Fraction Collector for 115V 60 Hz including:
	90 00 2317 Drop Counter Head 90 01 0385 Drop Nozzle 4 x 7005 Tube Racks 7007 Dust Cover (Pkt. of 2) 7011 Rack Tray 7024 Guide Arm 95 46 0138 Mains Cable, U.S.type 90 00 2539 Fuse Kit Instruction Manual and Spare Parts Catalogue
2070-002	UltroRac II Fraction Collector for 220V 50 Hz same as for 2070-001 except for 95 46 0137 Mains Cable, European type 90 00 2537 Fuse Kit
	OPTIONAL ACCESSORIES:
2120-001	VarioPerpex II Pump for 115V, 60 Hz
2120-002	VarioPerpex II Pump for 220V, 50 Hz
7005-1	Tube Rack for tubes 13-18 mm O.D. (Pkt. of 5, 1 orange + 4 white)
7005-2	Tube Rack for tubes 13-18 mm O.D. (Pkt. of 5, all white)
7018-1	Tube Rack for tubes 8-13 mm O.D. (Pkt. of 5, orange + 4 white)
7018-2	Tube Rack for tubes 8-13 mm O.D. (pkt. of 5, all white)
7011	Rack Tray (Pkt. of 2)
7017-1	Flow Stopper Valve, 115V 60 Hz
7017-2	Flow Stopper Valve, 220V 50 Hz
2070-101	Service Kit comprising:
	1 x 94 91 2324 Releasing Tool 1 x 90 00 1772 Adjusting Key 1 x 90 00 2835 Test P.C. Board
	OTHER ACCESSORY EQUIPMENT
	For full details of all accessory equipment available please ask you local LKB representative for the LKB Research Instruments Catalogue.

Printed in Sweden 05 1979 (LKB)

www.manualsplus.com
1029868

LKB

Stockholm · Athens · Copenhagen · Ghent · The Hague
Hong Kong · London · Munich · Paris · Rome · Turku · Vienna
Washington · Representatives in 50 countries.